

Chapter 4, Lesson 41, Adding window holes

In this lesson we are going to consider making holes for windows and doors in the building mesh that we have created and prepared in previous lesson.

- How do we get the right measurements from the reference image?
- Using the Boolean modifier

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To make the holes for windows and door we are going to use a new object that we will use to cut into the building mesh. Therefore, we will create a new object and shape it according to the doors and windows in our background reference image.

Since we don't have a blueprint that gives us exact measurements we will have to make an intelligent guess based on the reference. The secret here is to find the scale of different parts of the building in relation to each other. We start by creating a new object and align it with the door. From there we make a guess on how wide it is going to be and scale it to fit between the bottom of the door and the lowest point on the windows on either side of the door.

When doing this make sure you stay on one imaginary vertical line in your measurement. To make this a bit clearer let's look at this image.



The blue lines are in reality horizontal lines that always have the same distance between each other but in the photo, they are angled because of the camera's perspective. This means that all the orange lines are the same length. Therefore, if we follow multiple orange lines when we do our measurements we will end up with different measurements for different parts depending on which orange lines we followed for any given measure. It is best to use one of the lines to start off with. All objects will most likely not have intersecting parts on any one given line in an image in those cases you will have to make a guess on how much the blue horizontal lines are angled and compensate.

This process may seem long and complicated in writing but as you can see in the video it is made quite simple and quickly with practice. Try it out.

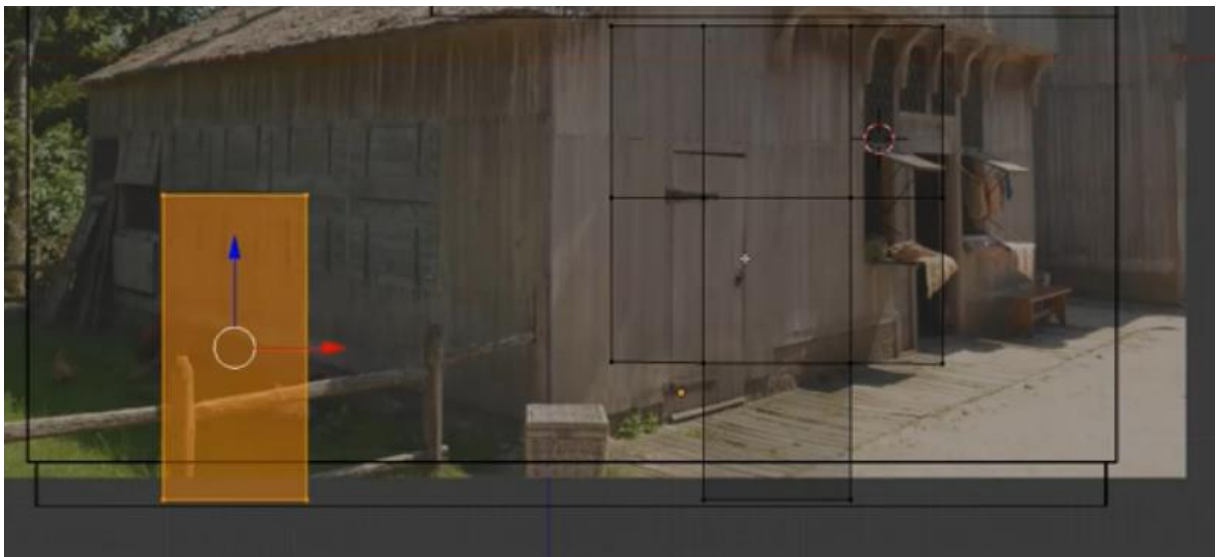
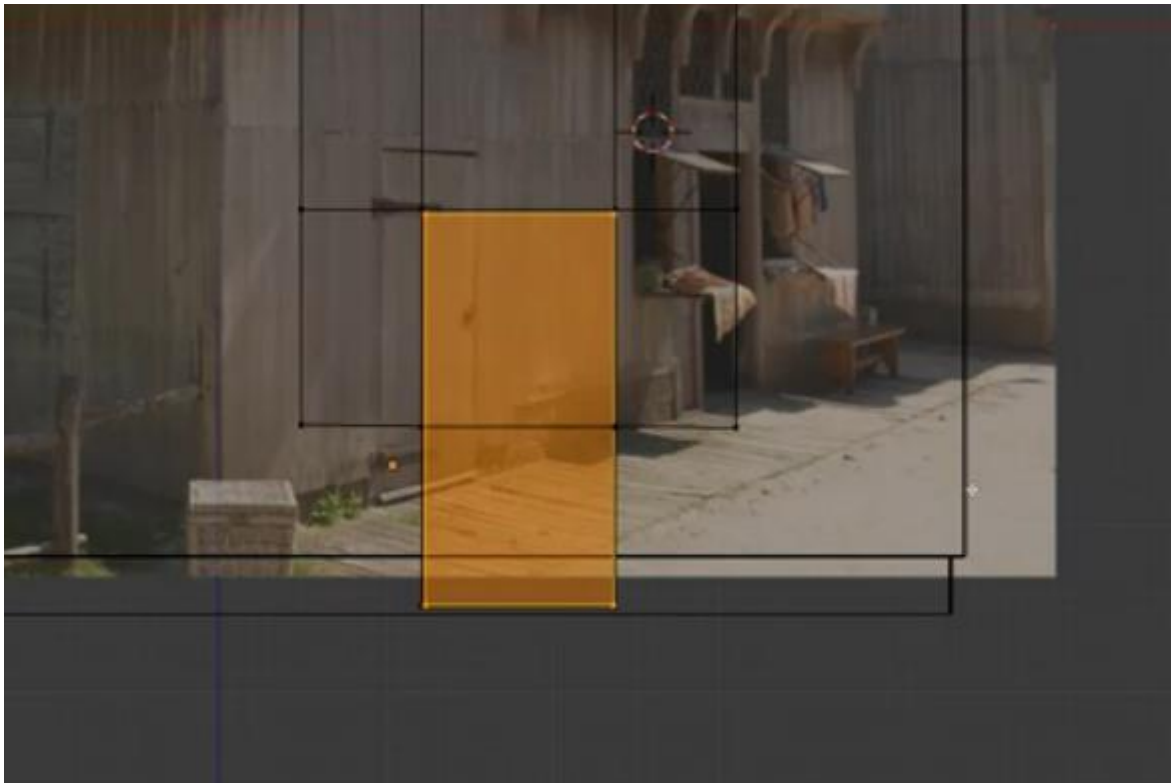
Next, we can also add some variation between the windows on either side by moving vertices slightly for realism. Nothing in the real world is straight and that is very much true for medieval buildings.



In the video we make a smaller version of the door and window frame first and then we scale it up to fit the building we have modeled. This is not a problem if the measurement within our object is correctly scaled. To make sure your object ends up in the middle add a temporary cube and scale it to fit on one side and move it to the other side for comparison. Delete it with **X** when you are done.

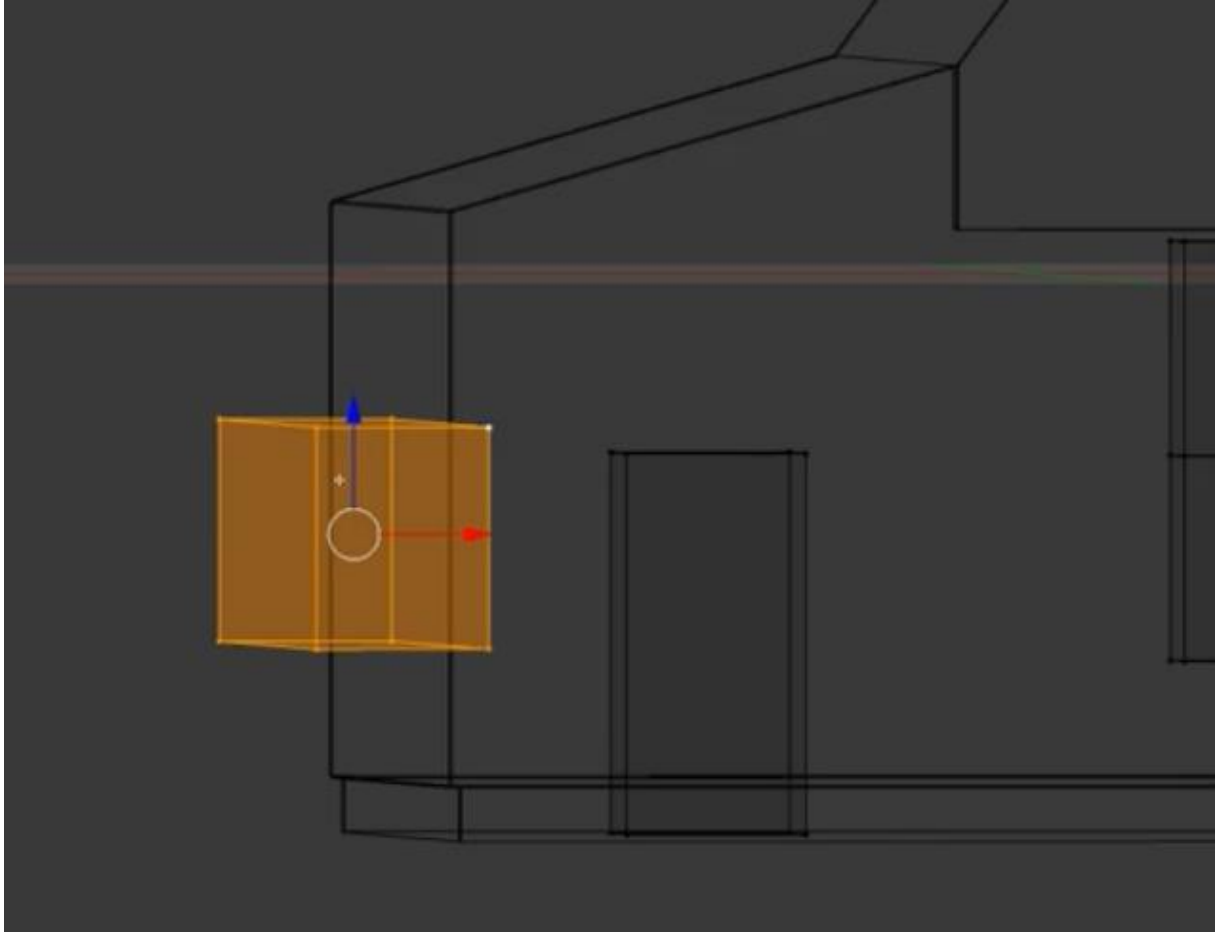


For the other door on the building front we can take the measurement from the door we already created. Add a new cube and align it to the first door we created and move it over to the other side of the frontside of the building.

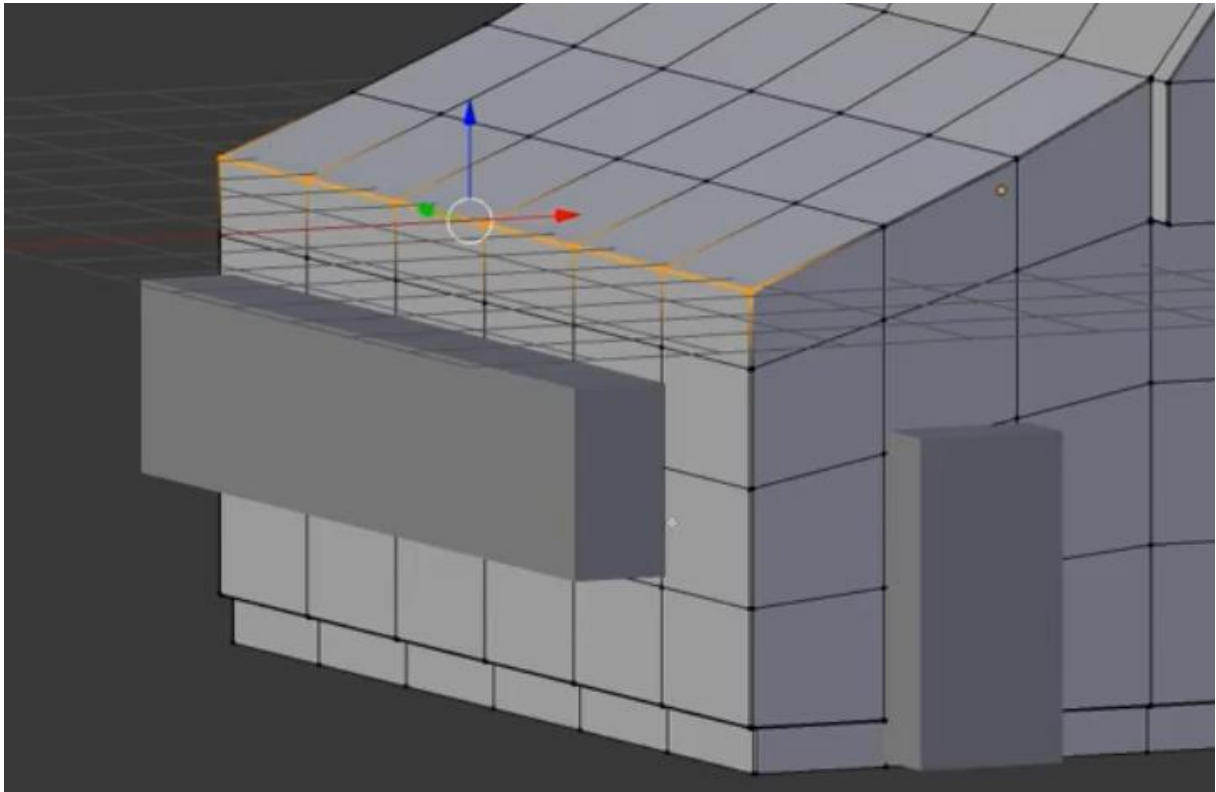


Now we move over to the windows at the top of the building. When doing these we have to consider that the upper floor is sticking out and is closer to us, therefore it appears slightly bigger. However, it is also higher up and therefore further away from us so that is something we also must keep in mind. In this case the fact that the building is sticking out and that the window is higher probably means that we can cancel out these two factors against each other. So why did we bring this up? Well, not all buildings that you are going to model is exactly like this one. Next time you might have a balcony.

For the hatches on the side of the building we could use the same measuring system as we did on the front door and windows. Here though our horizontal blue lines would angle the mirrored directions since we are on the other side of a 2-point perspective image. To align the hatches, you can use a similar thought pattern as we did earlier, however the fastest way to get the alignment right is to find a corresponding point on the opposite side of the image to compare against. In this case we use the height of the hatches to compare against the side door of the building. They are equal enough in height.

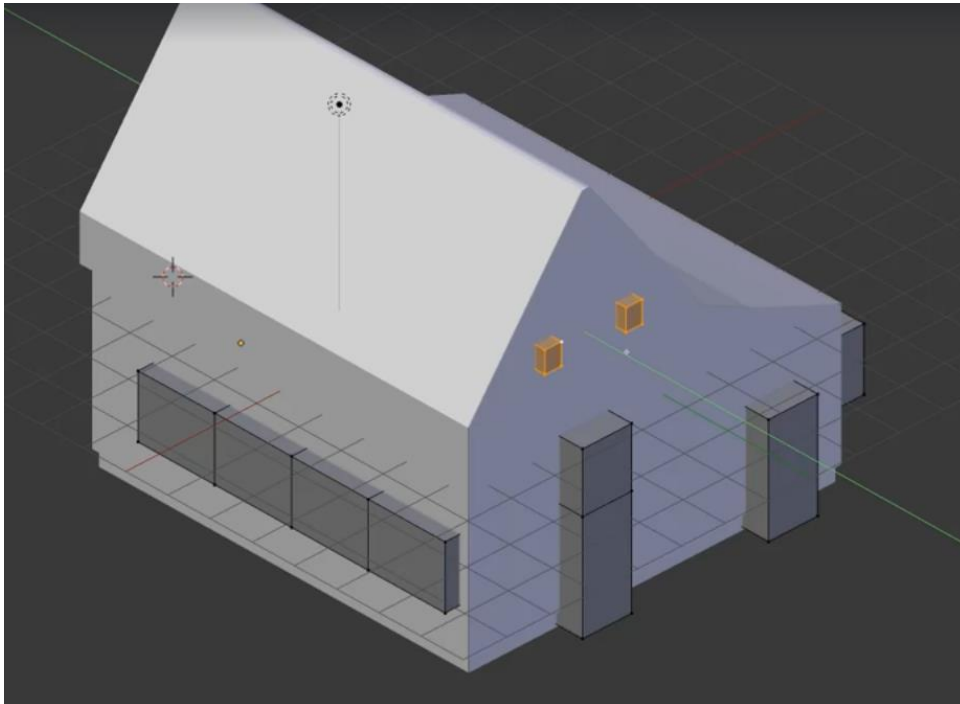


When we do this we also have to compare the hatches size against the door and keep in mind the distance between the hatches and the roof. If you have the same problem as in the video where the roof is too high. Don't be afraid to adjust the building.



Keep alternating between rotating the view with the mouse and going back to front and right orthographic view with the “1” and “3” on the numpad. Make sure it looks good and believable.

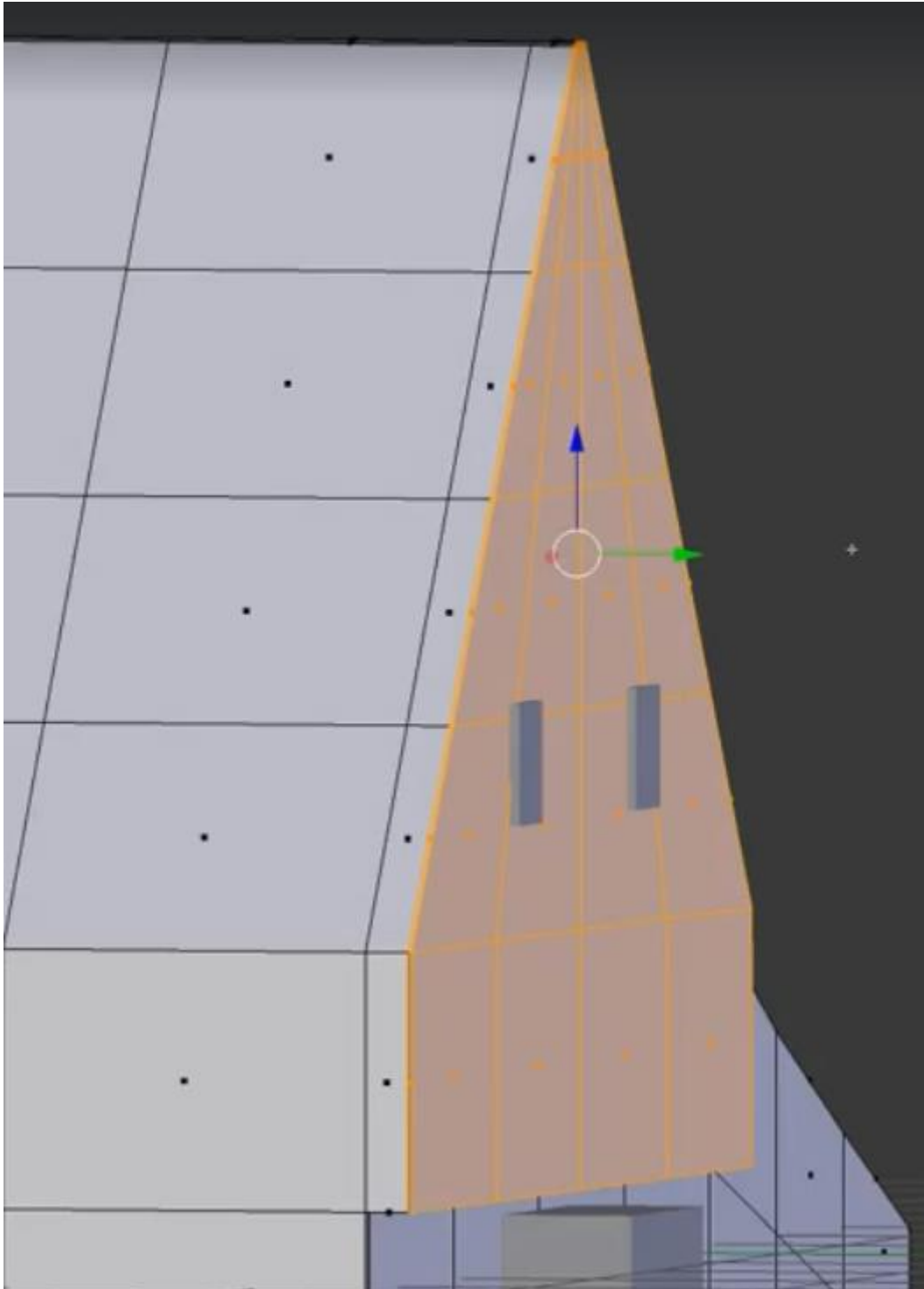
For the backside we have even more creative freedom and must make up our own design. In this case we start by trying out the same kind of hatches on the other side. Also duplicate over the side door. Use **shift+D** to duplicate.



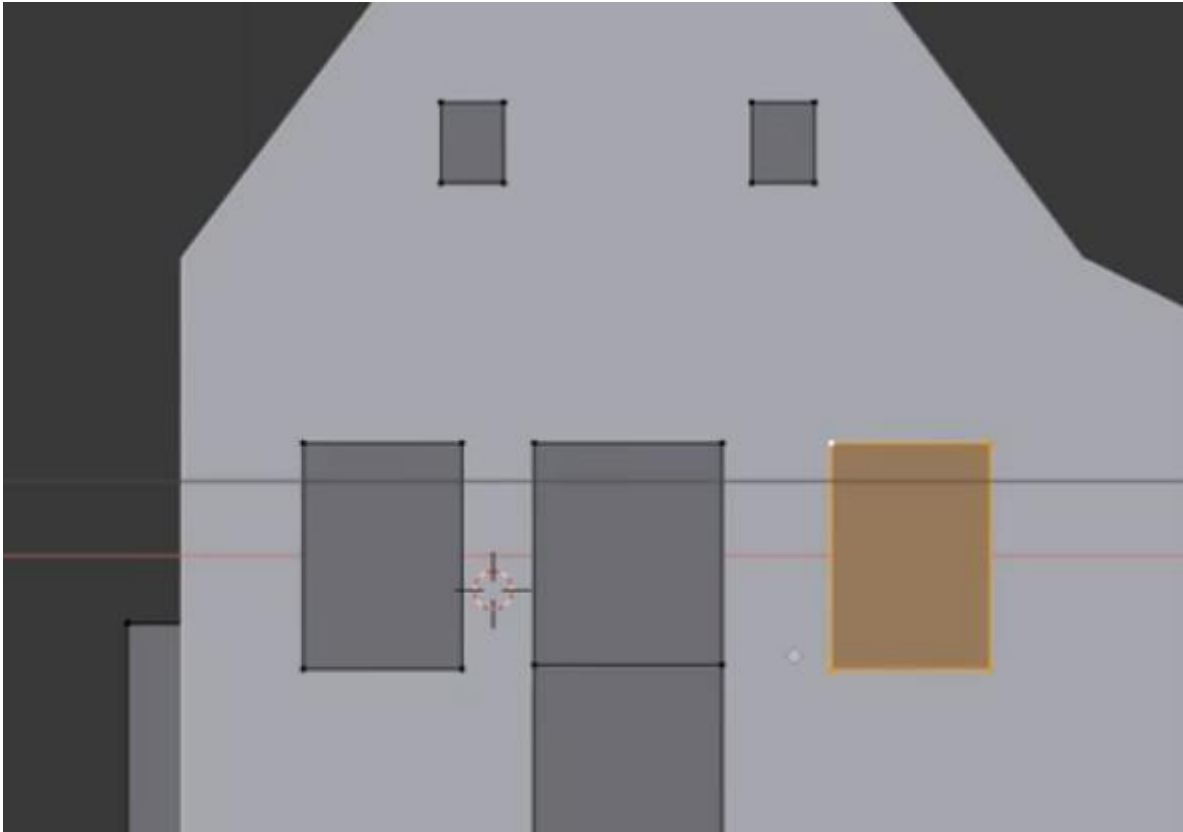
Duplicate the duplicated side door and raise it to have room for two additional windows above it. Then duplicate over the small windows on the second floor. At this point we want to make a small

alteration of the building design and add an extrusion to the upper floor on the back side, just like we did on the front. Select the backside faces as well as the beveled edge and extrude it.

(Note here that if you followed the alternate workflow for bevels in the documentation for the last video you don't have to select the beveled faces because they will not be selectable instead you have to go to edge select with **ctrl+tab**, select the edges that are still on the roof and not on the edge of the roof hit **ctrl+E** select "edge bevel weight" and press **"0"** and enter. Alternatively, the "edge bevel weight" setting is also available in the n-panel. Hit **"N"** and find the "Mean bevel weight" slider and slide it to 0. If only one edge is selected the name of this slider is changed to "bevel edge" only.)

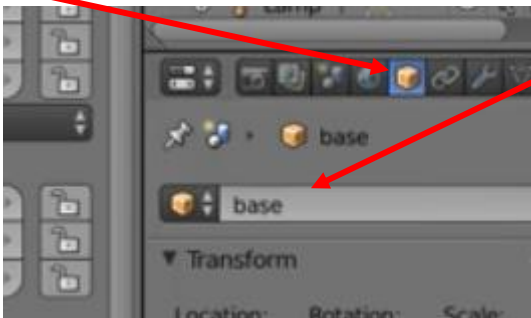


Last before we use the Boolean modifier we duplicate the top windows on the rear side of the building. Remember to use **"B"** and drag the mouse to box select or select a single face, edge or vertex on both windows and hit **ctrl+L** to select those two mesh islands. **Shift+D** to duplicate, scale them with **S** and use **G** to grab them into place.



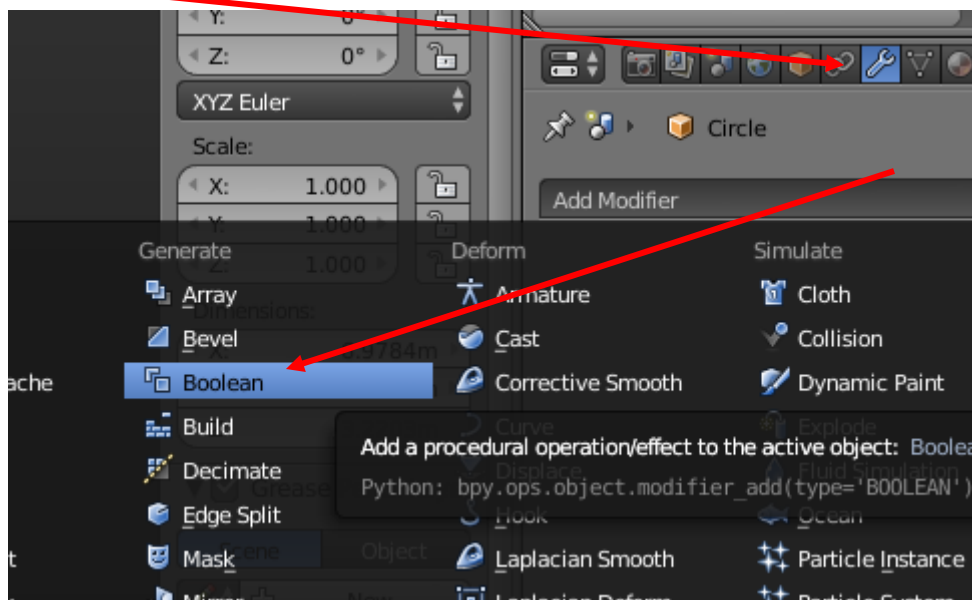
At this point we are done making our cutter object for the Boolean modifier. At this stage you may have multiple objects that make up the cutter object. If that is the case, select every object that is not the main building by holding **shift** and clicking on them all. Make sure that your lamp and camera is not selected. Hit **ctrl+j** to join them into one object. Follow up by using **ctrl+a** and apply rotation and scale. After this select the main building object alone and use **ctrl+a** and apply rotation and scale to that as well.

While the building is selected go to the properties panel, find the object data tab and name it "base".

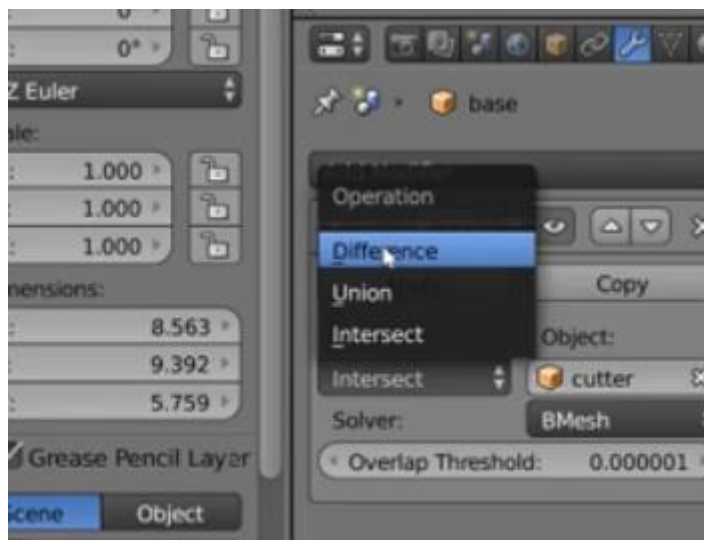


Do the same for the cutter object. Name it cutter.

We are now ready to add the Boolean modifier. Make sure that the “base” object is selected Go to the modifiers tab, add modifier and select “Boolean” from the list of modifiers.

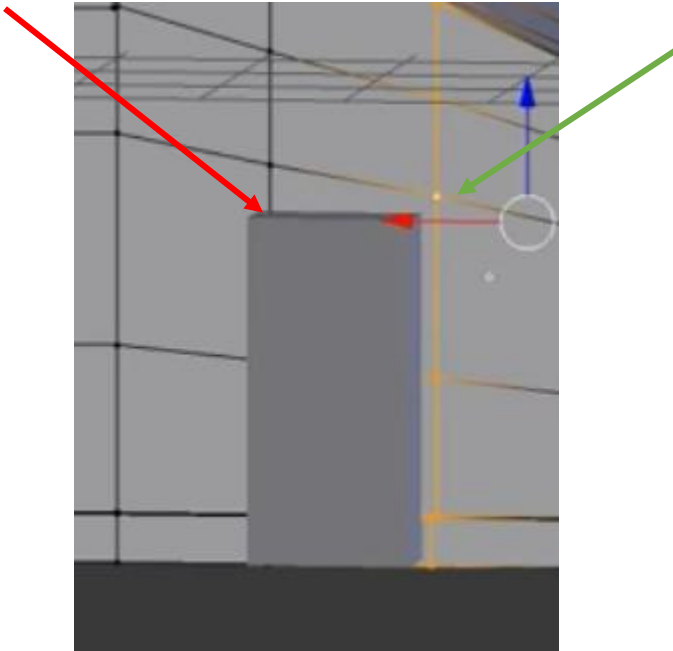


Now make the following settings on the Boolean modifier. Select Difference as the operation and the “cutter” as the object. This will make holes in the “base” objects mesh. From here you can apply the modifier but for now just select the “cutter” object and hit “H” to hide it. Hit **alt+h** to bring all hidden objects into view at any time. You can now see the result.



Now we will spend some time to optimize the base mesh for being used with the Boolean modifier before we apply it. The mesh of the cutter should preferable cut only at faces and across edges. In other words, we don't want to end up with geometry that leaves vertices very close to each other or very thin faces with edges running just next to each other. To avoid distorting the shape of the object while doing this try selecting an edge that needs to move and double tap “G” to slide the edge instead of moving it.

In this example we have a red arrow pointing at a location on the mesh that needs to be adjusted while the green arrow point at a portion that needs to be adjusted. More examples of how the mesh can be adjusted is shown in the video.



When you are done apply the modifier and take a look at the newly created mesh.